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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of John P. Carrico and Frank T. Stoner

Serial No.: Not yet assigned

Group Art Unit:

Filed: Herewith

Examiner:

For: **METHOD AND APPARATUS FOR SEQUENTIALLY PROFILING AND SOLVING
PROBLEMS IN SPACE MISSION ANALYSIS**

Assistant Commissioner for Patents
Box PATENT APPLICATION
Washington, D.C. 20231

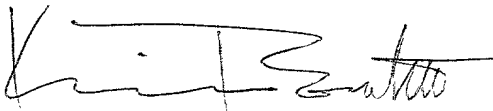
Dear Sir:

Enclosed please find the following:

1. Specification, abstract and claims (3 independent, 6 dependent, 9 total) (14 pages);
2. Informal drawings (4 figures, 4 sheets);
3. Declaration and Power of Attorney;
4. Assignment with Recordation Sheet;
5. Verified Statement Claiming Small Entity Status - Independent Inventor;
6. Verified Statement Claiming Small Entity Status - Small Business Concern;
7. One check in the amount of \$385.00 (\$345.00 for filing the application and \$40.00 for the assignment); and,
8. Certificate of Express mailing.

The Commissioner is hereby authorized to charge any fee deficiency, or credit any overpayment, to Deposit Account No. 18-1579. The Commissioner is also authorized to charge Deposit Account No. 18-1579 for any future fees connected in any way to this application. Two copies of this letter are enclosed.

Respectfully submitted,



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January 21, 2000

Atty. Docket No. 2493-025

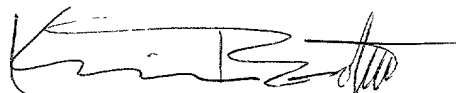
09/490173 U.S. PTO

CERTIFICATE OF EXPRESS MAILING

Express Mail Mailing Label Number EL528294847US

Date of Deposit: January 21, 2000

I hereby certify that the patent application of John P. Carrico and Frank T. Stoner for a **METHOD AND APPARATUS FOR SEQUENTIALLY PROFILING AND SOLVING PROBLEMS IN SPACE MISSION ANALYSIS** including the specification, abstract, and claims (3 independent, 6 dependent, 9 total) (14 pages); informal drawings (4 figures, 4 sheets); declaration and power of attorney; an assignment together with a recordation cover sheet; Verified Statement Claiming Small Entity Status - Small Business Concern; Verified Statement Claiming Small Entity status - Independent Inventor; and a check in the amount of \$385.00 (\$345.00 to cover the filing fee and \$40.00 to record the assignment), are being deposited with the United States Postal Service for "Express Mail" service under 37 C.F.R. § 1.10 on the date indicated above and are addressed to the Assistant Commissioner for Patents, Box Patent Application, Washington, D.C. 20231.



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January 21, 2000

Atty. Docket No. 2493-025

VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27(b))--INDEPENDENT INVENTOR

Docket Number 2493-025

Applicant or Patentee: John P. Carrico and Frank T. StonerSerial or Patent No.: Not Yet IssuedFiled or Issued: Herewith
 Title: **METHOD AND APPARATUS FOR SEQUENTIALLY PROFILING**
AND SOLVING PROBLEMS IN SPACE MISSION ANALYSIS

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

- ☒ the specification filed herewith with title as listed above.
- ☐ the application identified above.
- ☐ the patent identified above.

I have not assigned, granted, conveyed or licensed and am under no obligation under convey or law to assign, grant, convey or license any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that had made the invention, or to any concern which would not qualify as a business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(c).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☐ No such person, concern, or organization exists.
- ☒ Each such person, concern or organization is listed below.

Analytical Graphics, Inc.

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made an information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

John P. Carrico
 NAME OF INVENTOR

John P. Carrico
 Signature of inventor

14 Jan. 2000
 Date

Frank T. Stoner
 NAME OF INVENTOR

Frank T. Stoner
 Signature of inventor

14 Jan. 2000
 Date

 NAME OF INVENTOR

 Signature of inventor

 Date

**VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27(c))--SMALL BUSINESS CONCERN**

Docket Number 2493-025

Applicant or Patentee: John P. Carrico and Frank T. Stoner
 Serial or Patent No.: Not Yet Issued
 Filed or Issued: Herewith
 Title: **METHOD AND APPARATUS FOR SEQUENTIALLY PROFILING AND SOLVING
PROBLEMS IN SPACE MISSION ANALYSIS**

I hereby declare that I am

- ☐ the owner of the small business concern identified below:
☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF SMALL BUSINESS CONCERN Analytical Graphics, Inc.
 ADDRESS OF SMALL BUSINESS CONCERN 325 Technology Drive, Malvern, PA 19355

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.12, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees to the United States Patent and Trademark Office, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention described in:

- ☒ the specification filed herewith with title as listed above.
☐ the application identified above.
☐ the patent identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights in the invention must file separate verified statements averring to their status as small entities, and no rights to the invention are held by any person, other than the inventor, who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d), or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization having any rights in the invention is listed below:

- ☒ no such person, concern or organization exists.
☐ each such person, concern or organization is listed below.

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27).

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlements to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate (37 CFR 1.289(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Paul Graziani
 TITLE OF PERSON IF OTHER THAN OWNER President
 ADDRESS OF PERSON SIGNING 325 Technology Drive, Malvern, PA 19355
 SIGNATURE Paul L. Graziani DATE 1-14-00

1 **Title of the Invention:** Method and Apparatus for Sequentially Profiling and
2 Solving Problems in Space Mission Analysis

3
4 **Inventors:** John P. Carrico, Frank T. Stoner
5
6

7 **RELATED APPLICATIONS**

8 This application claims priority from U.S. provisional patent application no.
9 60/116,546, filed January 21, 1999.

10 **BACKGROUND OF THE INVENTION**

11 **1. Field of the Invention**

12 This invention relates generally to orbital planning. More particularly, this
13 invention relates to a system and method for orbital planning that allows iterative
14 calculations of orbital parameters to be accomplished in an automated way with one
15 parameter solution serving as input to the next parameter's calculation.

16 **2. Background Art**

17 In the process of a space mission analysis, the analyst must often perform
18 repetitive calculations. Frequently such calculations require the analyst to set up a
19 problem (or "case"), run the problem, and then review the results. After reviewing the
20 results, the analyst will set up another problem based on those results and run the
21 calculations again. Typically, the problems are addressed and solved in order of
22 increasing complexity.

23 An example of this process is determining how long to fire a spacecraft's engines,
24 and in what direction, in order to place the spacecraft in a desired orbit. This problem can
25 be broken down into two sub-problems. First, the analysts may wish to determine the
26 appropriate duration of firing to achieve the desired orbit in part. After this problem is

1 solved, and using its solution, the analyst can solve the combined problem of determining
2 the duration *and* direction of the engine firing.

3 It has generally been necessary to use computer languages and scripts to carry out
4 the sequential profiling and solving of a complex space mission analysis problem. That
5 process is cumbersome and time consuming and, depending on the programming
6 background of the analyst, may require him or her to learn a new programming or script
7 language. The prior art includes one program that makes use of a graphical user interface
8 (GUI) for the individual profiling of a problem, but each problem in a sequence of
9 problems must be profiled and processed manually.

10 It would therefore be useful to have the ability to solve profiles for space mission
11 planning in an automated way. Ideally a system that allows a user to establish a series of
12 sub-profiles, solve those sub-profiles and provide the response to the next sub-profile
13 problem would give the analyst the most flexibility in performing mission analysis.

14 SUMMARY OF THE INVENTION

15 It is an object of the present invention to provide a method that provides an
16 analyst with the ability to solve profiles for space mission planning.

17 It is another object of the present invention to provide a computer system that
18 automatically enables an analyst to solve profiles for space mission planning.

19 It is still another object of the present invention to provide a computer program
20 product that enables a computer to provide an analyst with the ability to automatically
21 solve profiles for space mission planning.

22 It is an object of the present invention to provide a method that provides an
23 analyst with the ability to establish a series of sub-profiles, and which solves each of those

1 sub-profiles and provides that solution as a basis for solving the next sub-profile in
2 sequence.

3 It is another object of the present invention to provide a computer system that
4 provides an analyst with the ability to establish a series of sub-profiles, and which solves
5 each of those sub-profiles and provides that solution as a basis for solving the next sub-
6 profile in sequence.

7 It is still another object of the present invention to provide a computer program
8 product that enables a computer to provide an analyst with the ability to establish a series
9 of sub-profiles, and which solves each of those sub-profiles and provides that solution as a
10 basis for solving the next sub-profile in sequence.

11 Some of the above objects are obtained by a method for profiling and solving
12 space mission problems. The method includes creating a space mission analysis scenario,
13 and setting up a control sequence that simulates a problem to be solved in the space
14 mission. The method further includes selecting control variables to be checked in solving
15 the problem, and identifying parameters to be used in defining a desired results that
16 represents an adequate solution to the problem. Additionally, the method includes
17 establishing profiles for each particular sub-problem of the problem to be solved, and
18 running simulations for each of the established profiles to provide a result representing a
19 solution to the problem to be solved.

20 Others of the above objects are obtained by a computer system embodied
21 according to the present invention. The computer system is adapted to perform profiling
22 and solving space mission problems for which a space mission analysis scenario has been
23 created. The system includes a processor and a memory that is addressable by the
24 processor. The memory includes software instructions adapted to enable the computer

1 system to perform a number of steps, including setting up a control sequence that
2 simulates a problem to be solved in the space mission, selecting control variables to be
3 checked in solving the problem, and identifying parameters to be used in defining a
4 desired results that represents an adequate solution to the problem. The software
5 instructions are also adapted to enable the computer system to perform steps of
6 establishing profiles for each particular sub-problem of the problem to be solved, and
7 running simulations for each of the established profiles to provide a result representing a
8 solution to the problem to be solved.

9 Still others of the above objects are obtained by a computer program product
10 embodied according to the present invention. The computer program product enables a
11 computer to perform profiling and to solve space mission problems for which a space
12 mission analysis scenario has been created. The computer program product includes
13 software instructions for enabling the computer to perform predetermined operations, and
14 a computer readable medium embodying the software instructions. The predetermined
15 operations include the steps of setting up a control sequence that simulates a problem to
16 be solved in the space mission, selecting control variables to be checked in solving the
17 problem, and identifying parameters to be used in defining a desired results that represents
18 an adequate solution to the problem. The predetermined operations also include steps of
19 establishing profiles for each particular sub-problem of the problem to be solved, and
20 running simulations for each of the established profiles to provide a result representing a
21 solution to the problem to be solved.

22 BRIEF DESCRIPTION OF THE DRAWINGS

1 **Fig. 1** illustrates an example, according to an embodiment of the present
2 invention, of a GUI panel used for selecting components used in defining desired results
3 (i.e., goals) for a given problem.

4 **Fig. 2** illustrates an example, according to an embodiment of the present
5 invention, of a user specifying desired values for the goal elements of a mission.

6 **Fig. 3** illustrates an example, according to an embodiment of the present
7 invention, of profiles being added and being re-ordered

8 **Fig. 4** illustrates an example, according to an embodiment of the present
9 invention, of the Target Sequence window showing that three profiles have been defined
10 for the space mission scenario.

11 **DETAILED DESCRIPTION OF THE INVENTION**

12 According to one embodiment of the present invention, a software program
13 employs a graphical user interface (GUI) to allow the user to set up a series of sub-
14 problems of any desired level of complexity. The program then implements the series
15 automatically and sequentially, incorporating the solution to one sub-problem into the
16 input to the next.

17 According to a preferred embodiment of the invention, the process claimed herein
18 is carried out in the context of an existing space mission analysis software program, such
19 as the Astrogator module of the Satellite Tool Kit (STK) program produced by Analytical
20 Graphics, Inc. of Malvern, Pennsylvania. The technical literature for the Satellite Tool
21 Kit program is incorporated herein by reference in its entirety, for all purposes.

22 Using an intuitive GUI, the invention is embodied to allow the analyst to specify
23 different problems in the form of a set of profiles. Each profile comprises one or more
24 selected target variables and one or more desired results. The user can select any given

1 profile and have the program solve the associated problem. In addition, the user can
2 specify a series of two or more profiles and have the software process them sequentially,
3 as described above.

4 For example, using the STK Astrogator module, the analyst first creates a space
5 mission analysis scenario. Within that scenario, the analyst sets up a control sequence
6 that simulates the problems to be solved. The invention then allows the analyst, through a
7 GUI, to select all the possible control variables that will be checked in solving the
8 problems and to define components to be used in defining desired results that represent
9 adequate solutions to the problems.

10 Once the control variables are selected and the desired results are specified, the
11 analyst proceeds to the profiling of each particular sub-problem. Using a GUI panel
12 specifically designed for this purpose, the analyst creates a profile specifying which of the
13 previously selected controls should be varied, and what results should be achieved. The
14 analyst can then use the invention to specify as many different profiles as needed, each
15 with its own lists of controls and desired results.

16 The analyst can also flag each profile as active or inactive, directing the software
17 program to run only those that are currently active. Since profiles and sequences thereof
18 can be saved together with the space mission analysis scenario, this is a convenience to
19 the analyst in the event that work must be re-run at a later date.

20 Once the profiles have been specified, the user can command the software via the
21 GUI to run the profiles. After each profile is run, the invention collects the solution to the
22 profile, and applies it as the initial starting point for the next profile (if appropriate).

23 The invention also allows the analyst to specify many different sets of profiles for
24 different sub-sequences that make up the overall sequence. The invention further allows

1 one or more sets of profiles to be automatically run as part of another set of profiles. In
2 other words, in running a given sequence that is being investigated as part of a set of
3 profiles, it may be necessary to run a different set of profiles as part of that sequence.
4 The invention allows this "nesting" of profile sets.

5 When profiles are nested, the invention also allows the analyst to select a desired
6 result of an inner profile to be used as a control variable in an outer profile. It also
7 allows the solution of an inner profile to be used as a result of an outer profile.

8 As noted above, the present invention is a series of modules running on a
9 computer system to accomplish the mission analysis described. The present invention is
10 implemented via a general-purpose computer.

11 Referring to **Fig. 1**, the illustrated GUI panel is used for selecting components
12 used in defining desired results ("goals") for a given problem. The Targeted Goal Setup
13 screen **16** allows a user to establish goals and results for a given profile. A series of
14 available "components" are displayed for the user in an "Available Components" window
15 **10**. This shows a user all of the components that are available for the user to specify, for
16 example Eccentricity, Latitude, Altitude and all other components that a user might wish
17 to vary in performing mission planning and analysis. Placement buttons **18** allow the user
18 to select the components that the user wishes to vary.

19 When the user selects a component, it is transferred to a "Selected Components"
20 window **12**. Here the user can highlight the selected components for subsequent
21 manipulation or specification. Alternatively, the user can de-select a component using the
22 placement buttons **18**.

1 When a user highlights a component in the component "Selected Components"
2 window 12, the details and values associated with the selected component are displayed
3 in a "Component Details" window 14 where they can be specified or modified.

4 Referring to Fig. 2, the screen for allowing a user to specify desired values for the
5 goal elements and to determine which are to be used in a given profile is shown.

6 Variables 20 are displayed for the user, as are goals 22 which can be specified by the user
7 for various selected components. Goal elements 24, 26, 28 used in the given profile are
8 marked with an 'x'. Note that in this example, a value is defined for the element of
9 eccentricity, but that element is not used in the profile.

10 Referring to Fig. 3, the screen to add or modify profiles is illustrated. Profiles are
11 added and can be re-ordered if desired in the Add/Modify screen 30 using the GUI of the
12 present invention. Active profiles are marked with an 'x' 32, 34. In this example, the
13 profile named "Phase-2" is not being run, whereas "Phase-1" and "Phase-3" are being run.
14 This screen also allows a user to edit the profile being run in an Edit screen 36 which
15 allows the user to select the profile to be edited 38.

16 Referring to Fig. 4, the Target Sequence window 42 is illustrated. The
17 information in this window shows that three profiles 40 have been defined for this space
18 mission scenario.

19 The system and method of the present invention operates using a number of
20 standard processors known in the art. UNIX processors such as the Silicon Graphics SGI
21 IMPACT™ and SGI 02™, each with the Reality Engine™ or the Infinite Reality™
22 engine; the IBM RS6000 with Evans & Sutherland Freedom graphics accelerator; the
23 Hewlett-Packard™ HP9000™ with Evans & Sutherland graphics accelerator; the Sun
24 Microsystems SPARC™ station with Evans & Sutherland Freedom graphics accelerator;

1 the Sun Microsystems UltraSUN™ with Creator3D graphics hardware; Digital
2 Equipment Corporation 4D50T and 4D60T processors, may each be used to implement
3 the present invention. Microsoft Windows operating system hardware also can be used to
4 implement the present invention with MS Windows, Windows95, and Windows NT
5 operating systems with or without OpenGL Accelerators. Generally, all of the above
6 systems should also have 48 Mbytes of memory and at least 75 Mbytes of hard drive
7 space available.

8 A system and method for sequentially profiling and solving problems in space
9 mission analysis has been disclosed. It will be appreciated by those skilled in the art that
10 other variations may be possible without departing from the scope of the invention as
11 disclosed.

WHAT IS CLAIMED IS:

1 1. A method for profiling and solving space mission problems, the method
2 comprising:

3 creating a space mission analysis scenario;

4 setting up a control sequence that simulates a problem to be solved in the space
5 mission;

6 selecting control variables to be checked in solving the problem;

7 identifying parameters to be used in defining a desired results that represents an
8 adequate solution to the problem;

9 establishing profiles for each particular sub-problem of the problem to be solved;

10 and

11 running simulations for each of the established profiles to provide a result

12 representing a solution to the problem to be solved.

1 2. The method of claim 1, wherein the step of running simulations for each of the
2 established profiles comprises:

3 after each profile is run, collecting the solution to that profile, and, in the event
4 that there is a subsequent profile to be run, applying it as the initial starting
5 point for a subsequent profile; and

6 collecting the solution to the last profile and providing it as the result representing
7 a solution to the problem to be solved.

1 3. The method of claim 1, wherein the step of establishing profiles for each
2 particular sub-problem of the problem to be solved comprises:

3 specifying which of the previously selected control variables should be varied for
4 each particular sub-problem, and
5 specifying what results should be achieved for each particular sub-problem.

1 4. A computer system adapted to perform profiling and solving space mission
2 problems for which a space mission analysis scenario has been created, the system
3 comprising:

4 a processor;

5 a memory, addressable by the processor, including software instructions adapted
6 to enable the computer system to perform the steps of:

7 setting up a control sequence that simulates a problem to be solved in the space
8 mission;

9 selecting control variables to be checked in solving the problem;

10 identifying parameters to be used in defining a desired results that represents an
11 adequate solution to the problem;

12 establishing profiles for each particular sub-problem of the problem to be solved;

13 and

14 running simulations for each of the established profiles to provide a result

15 representing a solution to the problem to be solved.

1 5. The computer system of claim 4, wherein the step of running simulations for
2 each of the established profiles comprises:

3 after each profile is run, collecting the solution to that profile, and, in the event

4 that there is a subsequent profile to be run, applying it as the initial starting

5 point for a subsequent profile; and

6 collecting the solution to the last profile and providing it as the result representing
7 a solution to the problem to be solved.

1 6. The computer system of claim 4, wherein the step of establishing profiles for
2 each particular sub-problem of the problem to be solved comprises:
3 specifying which of the previously selected control variables should be varied for
4 each particular sub-problem, and
5 specifying what results should be achieved for each particular sub-problem.

1 7. A computer program product for enabling a computer to perform profiling and
2 solving space mission problems for which a space mission analysis scenario has been
3 created, the computer program product comprising:
4 software instructions for enabling the computer to perform predetermined
5 operations, and
6 a computer readable medium embodying the software instructions;
7 the predetermined operations including the steps of:
8 setting up a control sequence that simulates a problem to be solved in the space
9 mission;
10 selecting control variables to be checked in solving the problem;
11 identifying parameters to be used in defining a desired results that represents an
12 adequate solution to the problem;
13 establishing profiles for each particular sub-problem of the problem to be solved;
14 and
15 running simulations for each of the established profiles to provide a result
16 representing a solution to the problem to be solved.

1 8. The computer program product of claim 7, wherein the step of running
2 simulations for each of the established profiles comprises:
3 after each profile is run, collecting the solution to that profile, and, in the event
4 that there is a subsequent profile to be run, applying it as the initial starting
5 point for a subsequent profile; and
6 collecting the solution to the last profile and providing it as the result representing
7 a solution to the problem to be solved.

1 9. The computer program product of claim 7, wherein the step of establishing
2 profiles for each particular sub-problem of the problem to be solved comprises:
3 specifying which of the previously selected control variables should be varied for
4 each particular sub-problem, and
5 specifying what results should be achieved for each particular sub-problem.

ABSTRACT OF THE DISCLOSURE

1 A system and method for orbital planning allows iterative calculations of orbital
2 parameters to be accomplished in an automated way with one parameter solution serving
3 as input to the next parameter's calculation. A software program employs a graphical user
4 interface (GUI) to allow a space mission analyst to set up a series of sub-problems of any
5 desired level of complexity. The program then implements the series automatically and
6 sequentially, incorporating the solution to one sub-problem into the input to the next.

Figure 1

Targeter Goal Setup

Field Name: Results

Field Description: User selected results for this segment

Available Components:

<input checked="" type="checkbox"/>	Default
<input checked="" type="checkbox"/>	Epoch
<input checked="" type="checkbox"/>	Vx
<input checked="" type="checkbox"/>	Vy
<input checked="" type="checkbox"/>	Vz
<input checked="" type="checkbox"/>	X
<input checked="" type="checkbox"/>	Y
<input checked="" type="checkbox"/>	Z
<input checked="" type="checkbox"/>	Altitude
<input checked="" type="checkbox"/>	Latitude
<input checked="" type="checkbox"/>	Longitude
<input checked="" type="checkbox"/>	Argument of Periaapsis
<input checked="" type="checkbox"/>	Eccentricity
<input checked="" type="checkbox"/>	Inclination
<input checked="" type="checkbox"/>	Mean Anomaly
<input checked="" type="checkbox"/>	RAAN
<input checked="" type="checkbox"/>	Semimajor Axis
<input checked="" type="checkbox"/>	True Anomaly
<input checked="" type="checkbox"/>	Delta-V
<input checked="" type="checkbox"/>	Absolute Value
<input checked="" type="checkbox"/>	Negative
<input checked="" type="checkbox"/>	Delta Declination

Selected Components:

<input checked="" type="checkbox"/>	Argument of Periaapsis	Angular distance from the ascending node to periaapsis
<input checked="" type="checkbox"/>	Eccentricity	Eccentricity of the conic orbit
<input checked="" type="checkbox"/>	Inclination	Inclination of the plane of the orbit
<input checked="" type="checkbox"/>	Semimajor Axis	Half the major axis of the conic orbit
<input checked="" type="checkbox"/>	Time Past Periaapsis	Time past the periaapsis of the conic orbit
<input checked="" type="checkbox"/>	True Anomaly	Angular distance between the orbiting object and periaapsis

Component Details:

Name	Value	Description
AsCM_Interface	AsStateCalc	AsCM
CoordSystem	Earth_Inertial	Coordinate
Description	Angular distance from the ascending node to periaapsis	Description
Type	AsStateCalcAvgPeriaapsis	Specificity
UserComment	Angular distance from the ascending node to periaapsis	User supplied

OK Cancel Apply Help

16

12

14

18

10

22,

Targeter Edit for Targeting_Profile			
Variables:			
?	Name	New Value	Last Update
x	DV_X	0.000000000000 km/sec	0.000000000000 km/sec
	DV_Y	0.000000000000 km/sec	0.000000000000 km/sec
			26
			28
Goals:			
?	Name	Desired	Achieved
	Argument_of_Perapsis	0.0000000000	0.0000000000
	Eccentricity	0.3000000000	0.0000000000
x	Inclination	23.5000000000	0.0000000000
x	Semimajor_Axis	43125.000000000000 km	0.0000000000
	Time Past Perapsis	0.0000000000 sec	0.0000000000
<input type="checkbox"/> Use			
Achieved Value:		0.0000000000	
Desired Value:		0.3000000000	
Difference:		0.0000000000	
Convergence Tolerance:		0.1000000000	
Advanced Values			
Scale:		1.0000000000	
Weight:		1.0000000000	
<input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Apply"/> <input type="button" value="Help"/>			
Variables:			
?	Name	New Value	Last Update
x	DV_X	0.000000000000 km/sec	0.000000000000 km/sec
	DV_Y	0.000000000000 km/sec	0.000000000000 km/sec
<input type="checkbox"/> Use			
Nominal:		0.000000000000 km/sec	
Correction:		0.000000000000 km/sec	
New Value:		0.000000000000 km/sec	
Last Update:		0.000000000000 km/sec	
Tolerance:		0.000000000100 km/sec	
Perturbation:		0.000100000000 km/sec	
Max. Step:		0.050000000000 km/sec	
Advanced Value			
Scale:		0.001000000000 km/sec	

Figure 3

30

Targeter: Add/Modify

Duplicate Delete

Name	Description	Active
Phase_1	DVX and ecc	x — 32
Phase_2	DVX, ecc & inc	
Phase_3	DVX, ecc,inc,sma	x — 34

38

36

Edit Sequence

Name: Phase_3 Update ...

Description: DVX, ecc,inc,sma

☒ Active

OK Cancel Apply Help

Figure 4

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Satellite1 - Basic Properties

Orbit | Altitude | Pass Break | Mass | RCS | Description |

Propagator: Astrogator

Initial State
Propagate
Target Sequence
Impulsive Maneuver
(end)
(end)

40

Action

Run Nominal Control Values

When Targeter Converges:

Run to RETURN and continue

Edit Variables and Goals ...

Add/Modify Profile list ...

Clear All Corr

Apply All Corr

Maximum Iterations: 25

Dynamic Draw

Convergence Criteria: Goals within tolerance

Advanced Options ...

Log File: SltTargeterLogFile.txt

View ...

Converged on last run: false

OK Cancel Apply Help

deg UTCG km sec

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of John P. Carrico and Frank T. Stoner

Serial No.: Not Yet Assigned
Filed: HERewith

Group Art Unit:
Examiner:

FOR: METHOD AND APPARATUS FOR SEQUENTIALLY PROFILING AND SOLVING PROBLEMS IN SPACE MISSION ANALYSIS

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As below inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, joint and first inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **METHOD AND APPARATUS FOR SEQUENTIALLY PROFILING AND SOLVING PROBLEMS IN SPACE MISSION ANALYSIS**, the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim the benefit under 35 U.S.C. § 119(e) of United States provisional application no. 60/116,546, filed January 21, 1999.

I hereby appoint the following attorney(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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